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LOS ALAMOS SCIENTIFIC LABORATORY

The hand of winter at Bandelier National Monument ruins.

Photo by LeRoy N. Sanchez

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Cover photo by LeRoy N. Sanchez: Injector room at meson physics facility.

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No "cue ball English" was available at LAMPF before. Physicists are now looking into a new realm of nuclear behavior.

Polarized Ions at LAMPF

By JEFF PEDERSON

Photos by LeRoy N. Sanchez

A new ion source is enabling a class of physics experiments that was not previously possible at existing energies of the Clinton P. Anderson Los Alamos Meson Physics Facility (LAMPF). "It's hard to build a source like this, but it's clearly what the people at the other end—the experimenters—want," said Phil Chamberlin, staff member at the Injector Systems section (MP-11).

Scientists familiar with polarized beams use the analogy of "putting English on the cue ball" to describe their effects. "You can do things that you could not ordinarily do. You can make shots you ordinarily couldn't make," Chamberlin continued.

In simple accelerator experiments, a beam of protons (the analogy would have them as tiny cue balls) strikes the target (billiard balls) and scattering occurs. Experiments can measure scattering angles and make estimates of whether the target nuclei are hard or soft, rounded or elliptical, tightly or loosely bound together.

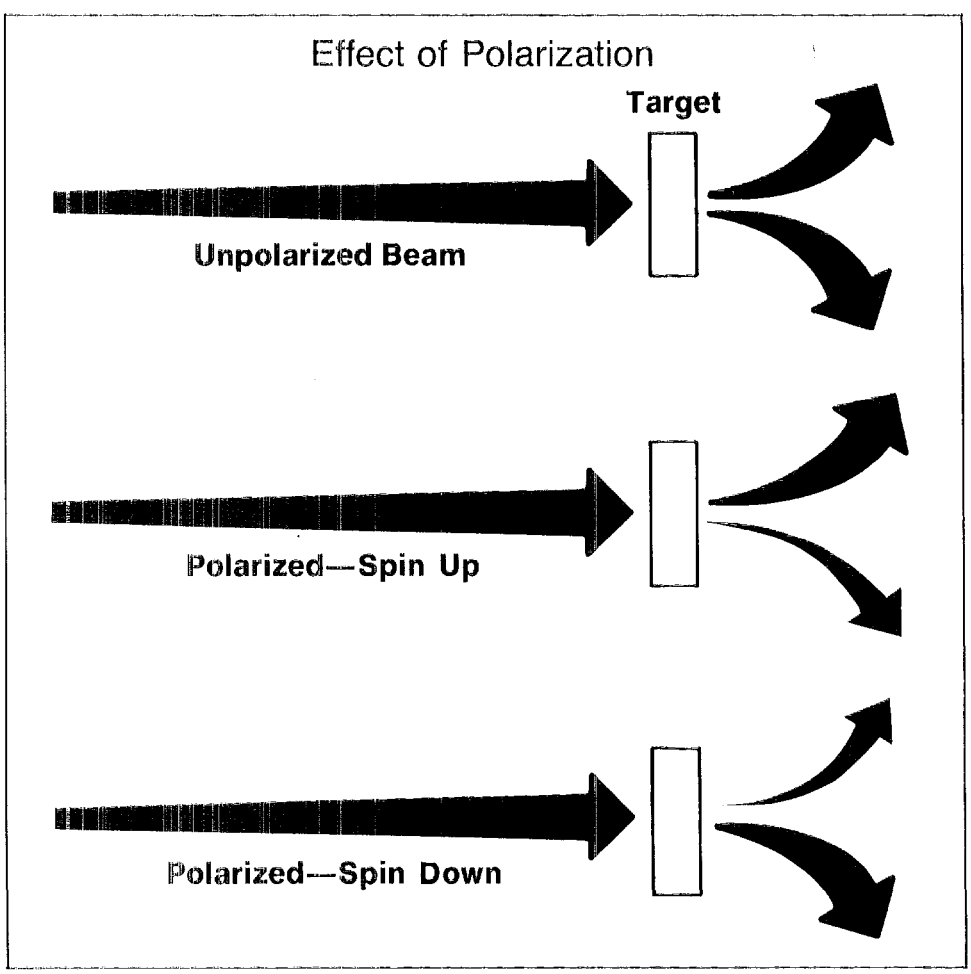
In other experiments, the cue ball itself can be spinning, as can the target balls. Scattering can be measured to determine whether, for instance, the cue ball is still spinning after the shot.

Three injectors

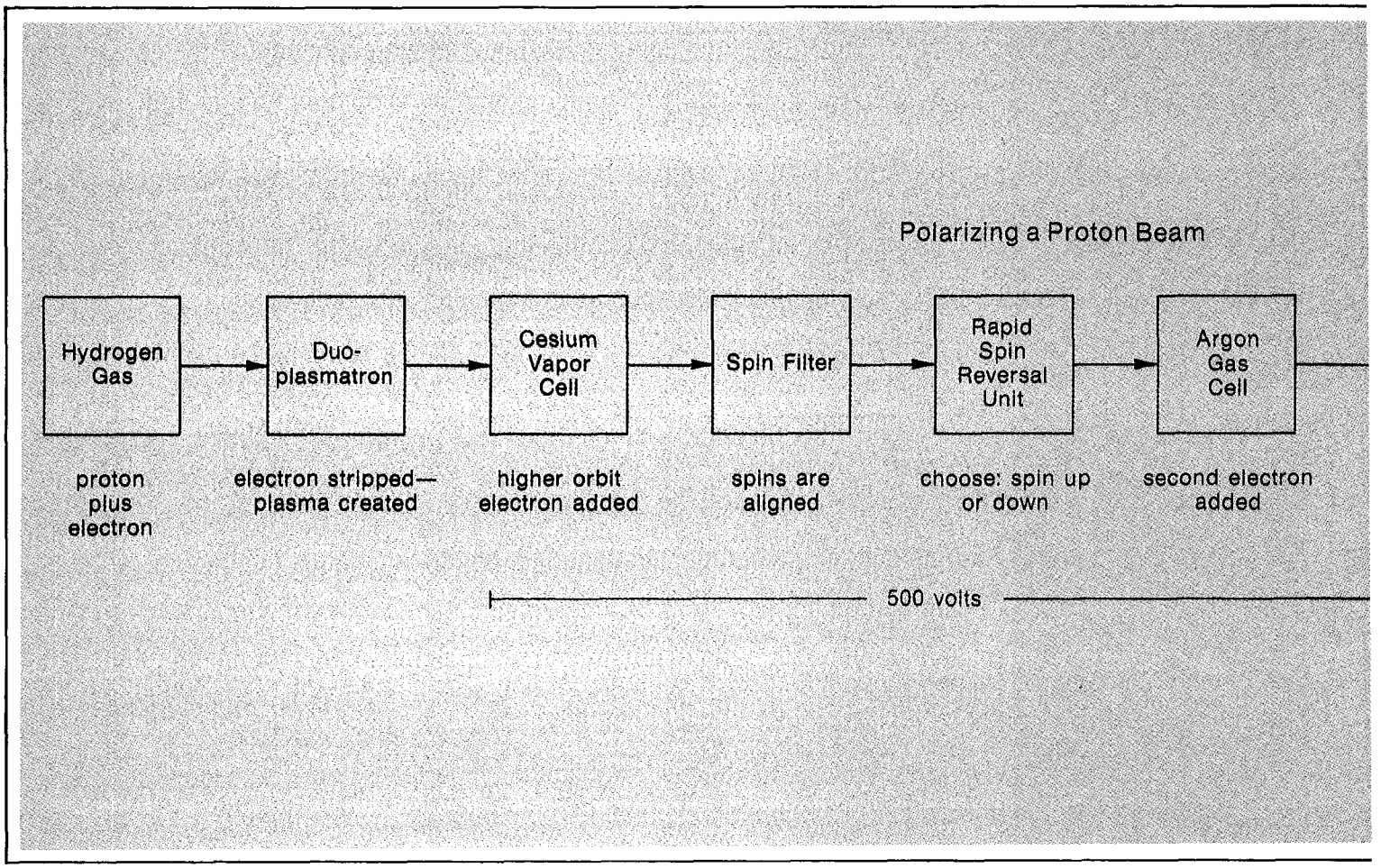
LAMPF now has three injectors, or sources of proton beams, which start as hydrogen. The main beam has always been, and still is, a product of the H+ source—protons. The H− source provides protons that have two added electrons. The new source is referred to as the P− source because it is polarized. Protons from all three injectors have spin but only in the P− source are the spins lined up in a non-random and controllable fashion.

With the H+ and H− beams, effects due to the proton spins are not measurable because of their random orientation. The P− source was built so that distinctions could be made. Spins of protons from the source are all aligned and can be sent to the target in any orientation. All of the beams move slowly in the source area, about 300,000 meters per second. They are first accelerated by a 750-kilovolt boost and are subsequently boosted down the beam line. They are moving at 84 per cent the speed of light when they reach the end of their half-mile flights.

The type of polarized source used at LAMPF is relatively new. The world's first



A closer look into the duoplasmatron tank shows yellow light reflecting off an accelerating lens, which pulses protons out.



The direction of polarization can be changed up to 3,000 times per second.

was designed and built by Joe McKibben and George Lawrence at Group P-9's Van de Graaff accelerator, where it is still operated. The LAMPF source is patterned after this design, though many modifications have been made.

None of the ion source's major components was available as an "off-the-shelf" item, so it took approximately two years for various LASL shops and outside vendors to fabricate what was needed. The plastic jacket surrounding the 750-kilovolt column, for example, is the world's largest Lucite spun casting.

Begins with hydrogen

The beam itself begins with a bottle of hydrogen gas. This is fed into a duoplasmatron where an electric arc knocks the electrons free of the hydrogen atom, creating a plasma. The protons (hydrogen nuclei minus their electrons) are then pulled out of the plasma by an electric field, which accelerates them. The protons then pass through a cloud of cesium vapor that is used to add one electron back onto the proton. These electrons must be in higher-than-normal orbits, however, if the resulting beam is to be of use.

This unusual orbit is called the metastable (almost stable) state and will last for a seventh of a second, unless it is disturbed in some way.

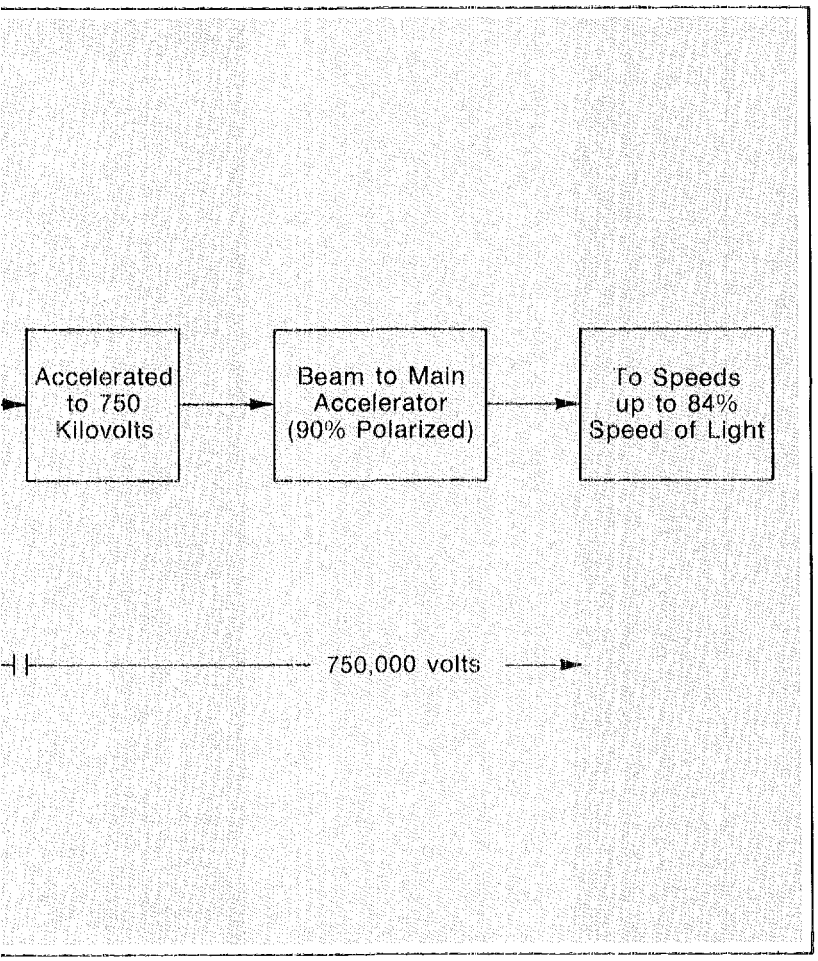
Metastable atoms then pass into the spin filter where a magnetic field is used to align their spins. Half of the spins will line up in the proper direction, while the other half are in the opposite direction. Electric fields (direct current and radio-frequency) are used to filter out the incorrectly lined atoms. These are eliminated by disturbing their metastable electrons so that they fall to the ground (or stable) state.

The beam, now polarized, is still electrically neutral, so it is passed through a cloud of argon gas where a second electron is added to each polarized atom to give it a net negative charge. The beam is then ready for acceleration from the injector dome to ground level.

As with other LAMPF sources, the polarized dome operates at 750 kilovolts. Optical light links are used to send signals from ground level to the dome for control of the equipment within it.

Beam quenching

The ion source, called a Lamb-shift source, also provides an important capability not available on atomic beam-type polarized sources. By "quenching" the beam, one can measure



None of the components was taken "off the shelf." It took two years to fabricate what was needed.

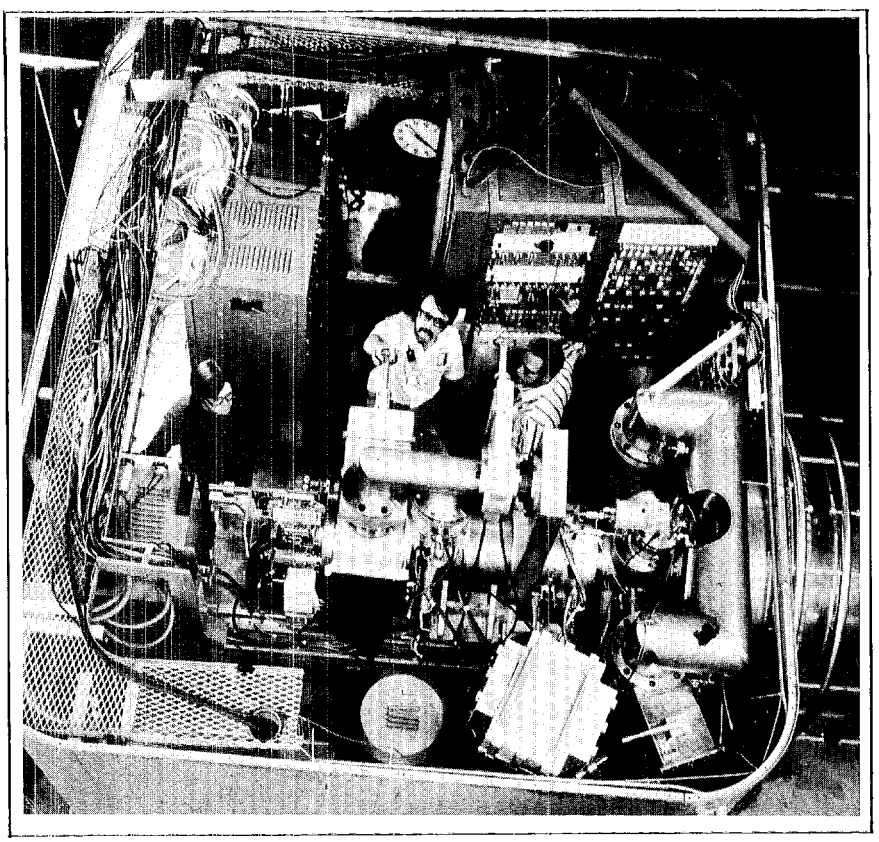
the degree of beam polarization before it is accelerated. On older sources, the beam had to be accelerated, and then scattered from a target, in order to determine how well it was polarized. A polarized beam is never completely polarized; it may be to 90 per cent or so.

The technique for this assessment, called quench ratio, was developed by McKibben and Gerald Ohlsen at the Van de Graaff machine. It significantly reduces the amount of beam time needed for several classes of experiments. No other machine running at LAMPF energies shares this capability. With quenching, the spin filter is "de-tuned" so only the unpolarized component is left to measure.

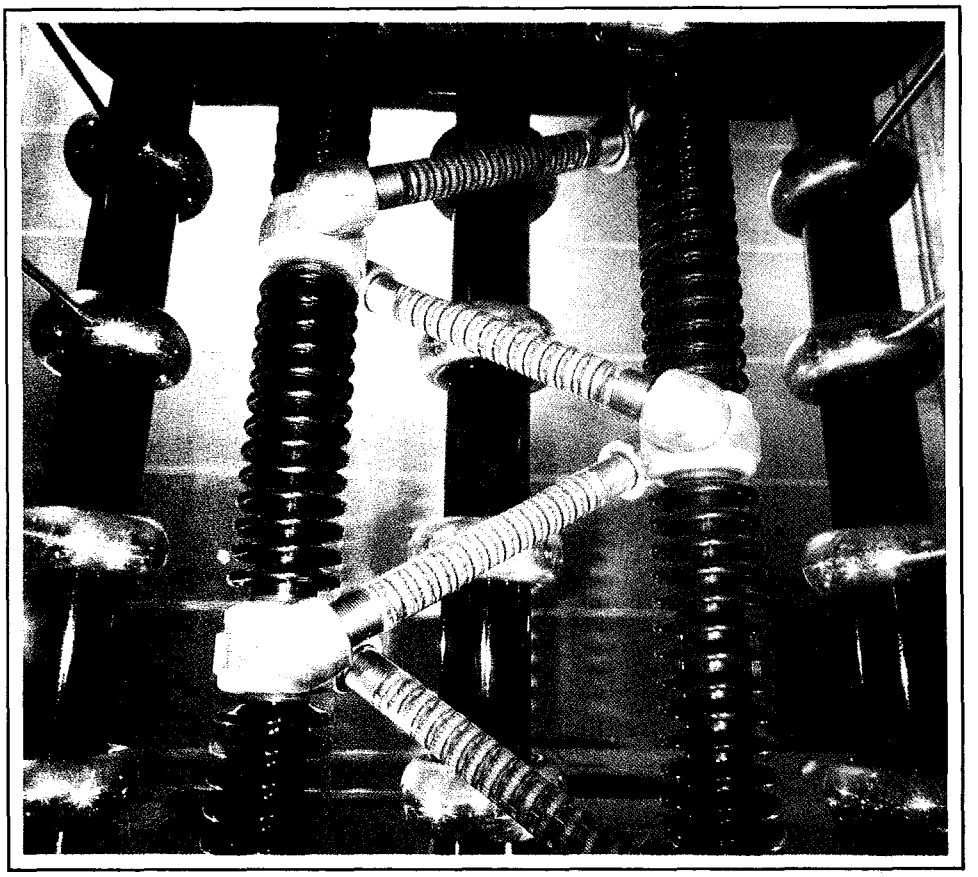
During the past year, the source's output was raised, making it now the most intense in the world, with a current of one microampere. This high intensity, together with the special features added for particular experiments, gives LAMPF experimenters great flexibility in planning and carrying out their work.

Spin reversal

One feature recently installed on the LAMPF source is the rapid spin reversal system. With it, the direction of polarization can be changed up to 3,000 times per second. This allows measurements to be made when the differences between "spin up" and "spin



The new ion source is housed in a dome, here seen with the top removed during installation. From top to bottom are Harry Williams, Phil Chamberlin, and Rob York.



Like an electronic flash used by a photographer, capacitors boost voltage at the ion source. The final 750 kilovolts at the top results from the beginning voltage at the bottom, multiplied by steps in the process. The brown columns are capacitors; the angled columns are diodes; and the blue columns are the legs on which the source sits.

down" are very small. The system was first designed to detect parity violations.

Parity theory states that there should be no observable differences between proton collisions when the spin is aligned in the direction of beam travel, and when the spin is opposite the direction of travel. The present measurements at LAMPF are to determine whether or not the theory is correct and must be sensitive to differences of one part in 10 million to be meaningful.

Many requests

Many other requests for polarized beam time have been submitted for this summer, said Mike McNaughton, staff member at Group MP-13 and a member of the LAMPF Users Group. Why the surge for polarized particles in the last few years, when LAMPF has operated with two other particle sources—both unpolarized—since 1972? Partly because no "cue ball English" was available until now, and partly because physicists are looking into a new realm of nuclear behavior.

Bill Bonner, staff member in Group P-7 and a Users Group member, is now using the polarized source to generate a polarized neutron beam. Neutrons, uncharged particles found in atomic nuclei, will accept the polarization spin from the LAMPF beam. The neutrons are then used to strike other targets.

There are other classes of experiments made possible by the polarized source at LAMPF. One encompasses the fundamental interactions of protons and neutrons in atomic nuclei. These experiments are called nucleon-nucleon interactions, since protons and neutrons in the nuclei are referred to as nucleons. This ongoing program takes up a large fraction of the polarized beam time.

Another set of experiments involves the high resolution spectrometer at LAMPF, where the interactions of polarized particles and heavy atomic nuclei are studied. Researchers look for "exotic excitations," such as the distribution of matter in a nucleus, or the volumes occupied by nucleons.

Targets that may be used in polarized experiments include liquid hydrogen, which esentially supplies protons. A researcher may study elastic scattering at impact (the billiard ball effect) or the production of pion particles upon collision (*pions are also used in medical research* at LAMPF).

Polarized targets have been developed for use at Los Alamos, although such research has been largely pursued in Europe. With these targets, particles can have their spins oriented in a manner similar to that of the incoming beam.

Cross sections

This summer a group of experimenters from Argonne National Laboratory and another group from Rice University and the University of Houston will run polarized beam and target experiments to see if previous data, showing some unexpected resonance-like behavior, are correct. They will be checking the total cross section of target nuclei as a function of the incoming particle energy at LAMPF.

Many persons have been involved in bringing the polarized source to fruition over a long period. They include Phil Chamberlin, staff member in charge; Harry Williams and Eddie Rios, who were responsible for all electronic work; John Leavitt, who did the mechanical layouts and drafting; Rob York, a new staff member who assisted; former MP-12 group leader Ralph Stevens; and John McConnell, who is responsible for operations of the Cockcroft-Walton power supply and the accelerating column.

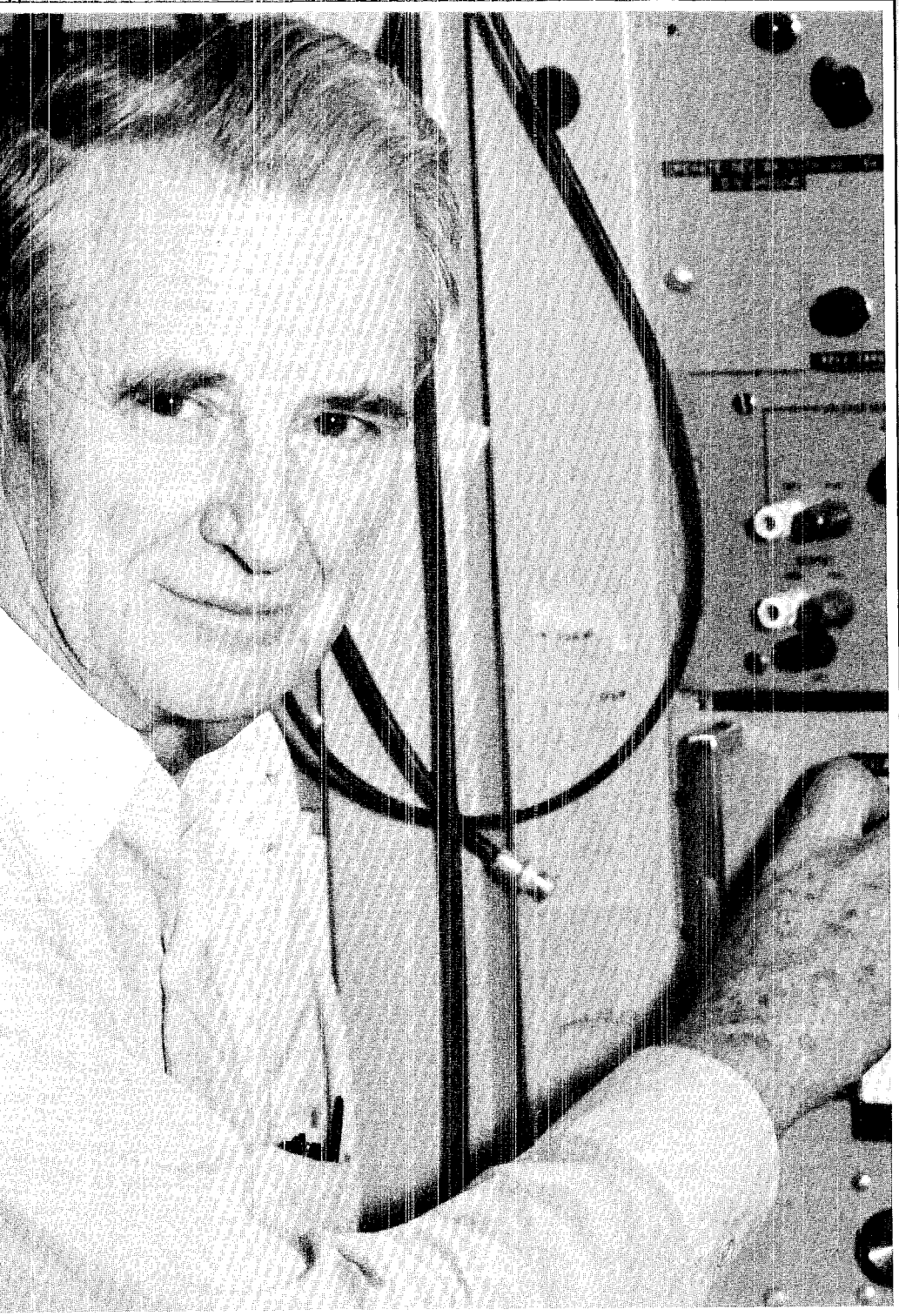
It is due to their, and others' work, that *the new ion source delivers polarized* beam to the experimental areas of the accelerator. Since 1972, LAMPF experiments in basic physics research, coupled with spinoffs in areas such as pion cancer treatment, and isotopes for the medical industry, have been fruitful. The polarized source is opening another door.

His Work Started in 1965 . . .

Joe McKibben has more than a passing knowledge of atomic behavior. With interest, he has assisted the LAMPF accelerator team as it built and installed a polarized ion source over the last two years—a source modified from a design he began work on 15 years ago.

"George Lawrence and I started building the source for the tandem Van de Graaff accelerator in 1965 and had a beam from it operating in the summer of 1969," he recalled. "At the Van de Graaff, we have accelerated polarized protons up to an energy of 16 million electron volts for nuclear physics experiments. This, of course, is a lot less energy than the 800-million-electron-volt protons accelerated at LAMPF, but still enough to give a lot of information."

McKibben, who in 1945 had the job of starting the automatic timing sequence for the Trinity atomic weapon test, plans to retire this year and become a LASL consultant. His 1965 ion source is still operating at the Van de Graaff machine, operated by P-9, where he was group leader for many years. He built much of the source himself, from machining metal components to wiring circuits.



At P-9, a polarized ion beam must be created in the form of negative hydrogen ions in order to be accelerated through the tandem Van de Graaff. The beam is available at any one of several different targets through evacuated beam lines from the tandem. Scattering experiments in helium gas, McKibben explained, with the proton's spin pointing up, render different data than random spins in the beam—showing that the beam is polarized.

At one beam stop, a "supercube" chamber, developed largely by Gerald Ohlsen, has particle detectors on each of its four sides to analyse the scattering of polarized particles on many elements. A different chamber is used for parity violation experiments. The experimental group that works with this chamber involves many LAMPF researchers. The accuracy needed in this experiment is one part in 10 million, so one has to scatter and detect the square of that many events—10 million times 10 million—a very difficult feat.

McKibben's ion source can also be used to polarize deuterons as well as protons. Tritons could be polarized (two neutrons and one proton) but that would require management of radioactive tritium in the system.

Robert Hardekopf has built a second polarized source at P-9, used to polarize tritons. It has a special pumping system to run the radioactive tritium gas back and forth through the source. The argon gas used to form the negatively ionized tritons (T^-) is pumped on a cryogenically cooled surface. Both McKibben's and Hardekopf's sources were steps toward the design of the ion source newly installed at LAMPF. The LAMPF spin filter, additionally, owes a lot in concept to Ohlsen's work at P-9.

"Here at Los Alamos," said McKibben, "we have three different polarized sources based on Lamb-shift physics." Similar sources elsewhere are at Duke University, the University of Washington, and in Canada at TRIUMF in Vancouver, and McMasters University in Hamilton, Ontario.

McKibben has consulted with LAMPF physicists since the large accelerator was in the conception stage in the early 1960s.

—JLP

MAMMOTH Project: *20,000 Plutonium Workers*

By CAROLANN RODRIGUEZ
Photos by John Flower

26 workers from the Manhattan Project were selected for studies. Intensely studied for nearly 30 years, they show no evidence of adverse health effects from plutonium.

Let's say you've looked long and hard at how plutonium affects its handlers. Then you've assembled evidence and published a solid study that says, "This group of workers shows no ill effects from its exposure to a radioactive element." Your work is quoted internationally. What do you do next?

You might do what LASL's Epidemiology Group (H-14) is– they're widening the scope of their studies because they think making it bigger will make it better.

As their experience accumulated, researchers here increased the sizes of the study population exponentially from a group of 26, to a group of 224, and now to nearly 20,000 persons who worked at six nuclear facilities sites across the nation.

They aim at a definitive answer to questions which have nagged health researchers: Were enough people investigated in previous studies? Enough to translate earlier findings into general trends? Enough to say that what was true for older Manhattan Project workers is still valid for nuclear workers everywhere today?

At least 10 years

"It's going to take at least 10 years, maybe 20, before we get enough evidence to supply the answers," said George Voelz, head of Health Division which is supervising the 20,000-subject study. Investigators will be fanning out to six sites for their data: Rocky Flats, near Golden, Colo.; the Mound Facility, Dayton, Ohio; Hanford Operations, Richland, Wash.; Savannah River, S.C.; Oak Ridge, Tenn.; and Los Alamos.

The study is a collaborative effort with the National Institute of Environmental Health Sciences. Once completed, it will be the largest, most comprehensive, and only national study of its kind.

Each of the sites has played a role in the U.S. nuclear complex. Rocky Flats machines plutonium into components for weapons. Hanford produced plutonium for the World War II effort and now develops fuels needed for fast breeder reactors. Savannah produces plutonium and fuel forms for radioisotopic generators. Oak Ridge made some of the first plutonium, and now processes enriched uranium.

As part of the Manhattan Project, the Mound Facility was responsible for studies on polonium, another radionuclide. Now its mission includes plutonium-238 isotopic heat source development. Los Alamos designs and tests nuclear warheads.

What investigators will be looking at are the study subjects' work histories, radiation and chemical exposures, and death certificates. What they'll be looking for are health trends among workers still alive, and causes of death for those who aren't.

Plutonium is a manmade metal discovered as a new element in 1941. It becomes available only after bombarding uranium with neutron particles. There are two difficult conditions in this process. Only a very small amount of plutonium can be separated from tons of uranium. Also, the workers involved in the process must be protected against the intensely radioactive fission products resulting from the processing.

Issue of protection

Workers involved in plutonium work will be the ultimate beneficiaries of the study. The more health researchers know about the effects of exposure to a potentially dangerous substance, the more protection can be provided effectively.

Protection against the hazards of radioactive substances was an important issue even before transuranic elements were discovered. When radium workers in the 1920s suffered ill effects from their handling of that newly discovered element, groups formed to study the effects and recommend safety procedures.

One such group was called the International Commission on Radiological Protection (ICRP). Working with similar-minded groups from different countries, the ICRP helped develop the first standardized measurement for radiation exposure, the roentgen. (One roentgen equals the quantity of ionizing radiation that will produce one electrostatic unit of charge in one cubic centimeter of dry air at 0 degrees Centrigrade and standard atmospheric pressure.)

To help advise the ICRP, the U.S. established a group, eventually known as the National Council on Radiation Protection and Measurements, in 1929. The groups looking at radiation hazards during that time were mostly concerned with the medical uses of radiation. Not until World War II did the focus switch to problems associated with the budding nuclear industry. After the war, the national council advising the ICRP was renamed the National Committee on Radiological Protection.

These two groups, The ICRP and the NCRP, have been responsible for recommending general standards for radiation protection. These standards were later incorporated into governmental regulations.

In Los Alamos . . .

In the mid-1940s, while studies were in progress on the standards, workers at the top-secret Manhattan Project in Los Alamos were working in wooden buildings on the world's first nuclear weapon.

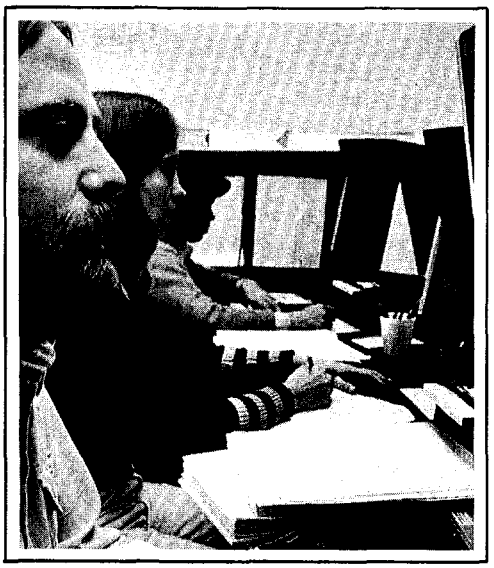
Plutonium, discovered only a few years before, was pronounced by theorists as capable of sustaining a nuclear fission reaction, suitable for weapons use. How to manufacture it in an effective form for such a purpose was part of the urgent wartime effort of the Manhattan project.

The bomb was built and successfully used. The war ended. In the years following, health investigators began looking at the effects of working with plutonium under the crude conditions of wartime emergency.

In the early 1950s, 26 plutonium workers from the Manhattan Project days were selected for clinical follow-up studies. This group was judged to have had the highest exposure to plutonium during the project days. The most common form of exposure was inhalation.

Minute amounts of plutonium were measured in urine assays of the subjects. Health workers used these measurements to estimate how much plutonium remained in the subjects' bodies. In 1952, the estimates of the plutonium deposits based on these measurements ranged from six to 80 nanocuries. This level is equal in weight to 0.6 micrograms, or 21 billionths of an ounce of plutonium.

Records from four national sites are now being compiled. Personnel will change through the years of this ambitious project. Don Gibbons, H-14, spent months sorting from thousands of papers.



"It's going to take at least 10 years, maybe 20, before we get enough evidence to supply the answers," said Voelz. Here, microfiche information is translated into code by David Klaus, Theresa Gorman, and Anita Ili Chen.

Workers will be the ultimate beneficiaries. The more health researchers know, the more protection can be provided.

(A curie is a unit of radioactivity, defined as 37 billion disintegrations per second. It is equal to the activity of one gram of radium. A nanocurie is one billionth of this unit, or 37 disintegrations per second.)

Since the 1952 medical check-ups, most of the group of 26 have taken intensive physicals every five years. During the period 1971-72, 22 of them returned to Los Alamos for further medical evaluations. They returned again in 1975-78. (Two of the subjects preferred not to travel and had examinations by their own physicians. Two others had died, one from injuries in an auto accident, another from a heart attack.)

Based on their studies of these men, LASL researchers and consultants wrote a paper on their findings entitled, "A Thirty-Two Year Medical Follow-Up of Manhattan Project Plutonium Workers." The paper was authored by Voelz, Louis Hempelmann, (LASL's first medical director and now a consultant), James Lawrence, and William Moss. Lawrence and Moss are still with the Health Division. Hempelmann later became chairman of the Radiology Department at the University of Rochester in New York.

Exclusive club

The exclusive club of 26 plutonium workers is among the most intensly studied medical subjects in the country. The study not only pinpointed the types of exposures the subjects had in 1944-45 (inhalation, contaminated wounds and chemical burns by plutonium-containing solutions), but also noted work histories of the subjects following Manhattan Project days.

Their body counts were refined via a measurement method called *in vivo* counting for internal alpha emitters. Urinalysis for plutonium was also used.

The general health of the subjects was noted, along with their medical histories and health habits. Chest, dental, and bone x rays were taken, as were tests of lung function and blood chemistries. Also performed were chromosome and sputum analyses, and electro-cardiograms.

Laboratory researchers have found in animal experiments that plutonium's alpha radation can cause major health problems at higher dose levels. The alpha rays will not penetrate the surface layer of unbroken skin, but can cause severe damage to human tissues if they find another way in.

When plutonium does find a way in, it lodges principally in the lungs, liver, and bones, and thus delivers higher radiation doses to these tissues than to other organs. The formation of cancer in these organs many years later is a key concern and major point for study in these workers.

However, the results of this medical survey indicated that neither cancer mortality rates nor cancer incidence was out of the ordinary for the workers studied.

There were no deaths due to cancer, nor were any cancers diagnosed except for two cases of skin cancer. One of the skin cancers involved a mole present since childhood. The other was on the back of the hand of a subject who had a fair complexion. Both cancers were removed successfully some time ago.

The conclusions of this first study on plutonium workers?

"The diseases and physical changes noted in the group are characteristic of a male population in their 50s and 60s. This study yields no evidence suggesting that adverse health effects have resulted from 32 years of exposure to the internally deposited plutonium."

One year after the results of the 26-subject study were in, LASL's health researchers initiated another, this time aiming for all Los Alamos workers identified as having accumulated 10 nanocuries or more of plutonium within their bodies. A review of health physics records showed 224 male workers eligible for the study.

Search campaign

Not all the workers were here, and so began a people-finding campaign. Those still in Los Alamos were easy to find—a look in the phone book yielded many names. A phone call or two was needed for verification in most cases. In others, a real private eye search was conducted to track down current addresses.

It took some time and lots of tries to track down all 224, but it was done. By 1978, investigators could report a 100 per cent follow-up, unusual for a study of this size.

James Stebbings, an epidemiologist who helped coordinate the 224-subject study, and who later became leader of the newly formed Epidemiology Group, said such a thorough follow-up rate is rare. "Normally, we could expect only about 90 per cent return," he said. "But we were lucky to have tracers (persons who man the phones searching) who took a personal interest in the subjects." (See separate story on Lilian Anaya.)

"What also helped were the fantastic records LASL kept, and the community spirit we found among workers in the

nuclear industry," said Stebbings.

This study concentrated on 30-year mortality rates for the 224 subjects, and the reasons behind what deaths occurred. The results fell in line with the earlier study on the Manhattan Project workers. For almost all cases of death, and especially for cancer, mortality rates were lower than expected.

Expanded effort

Back to the original question. Is it enough? First, 26, then 224 subjects, were studied. Would the trends shown among those studied so far continue for workers at other nuclear sites?

There is only one way to find out. Start asking.

This latest effort, involving 20,000 employees at six sites across the nation, by any measuring stick is a mammoth project. Like the study of 224, it will not involve physically examining the subjects, but will center around heaps of paper.

The first stage of the study is an inventory of all records systems at the sites: personnel, health, and health physics. Stebbings said it appears there is no common format by which sites kept records. Computerized records, which would ease data gathering, are not consistently available at the sites. Many of the records, however, have since been recreated, since much of the data predated the availability of computers.

Death rates, by specific causes of death, will be derived through a review of death records obtained from the Social Security Administration. Data from the questionnaires returned from 8,000 of the subjects will provide information on health habits such as smoking, serious medical problems including major operations, long-term illnesses, and kinds of medical treatment. Subjects will also be queried on the types of jobs held, for how long, and whether any possible hazards were involved.

"We need as much information as we can get on any other possible factors that may affect, or have affected their health," said Voelz. "When you're studying plutonium, you can't ignore other factors."

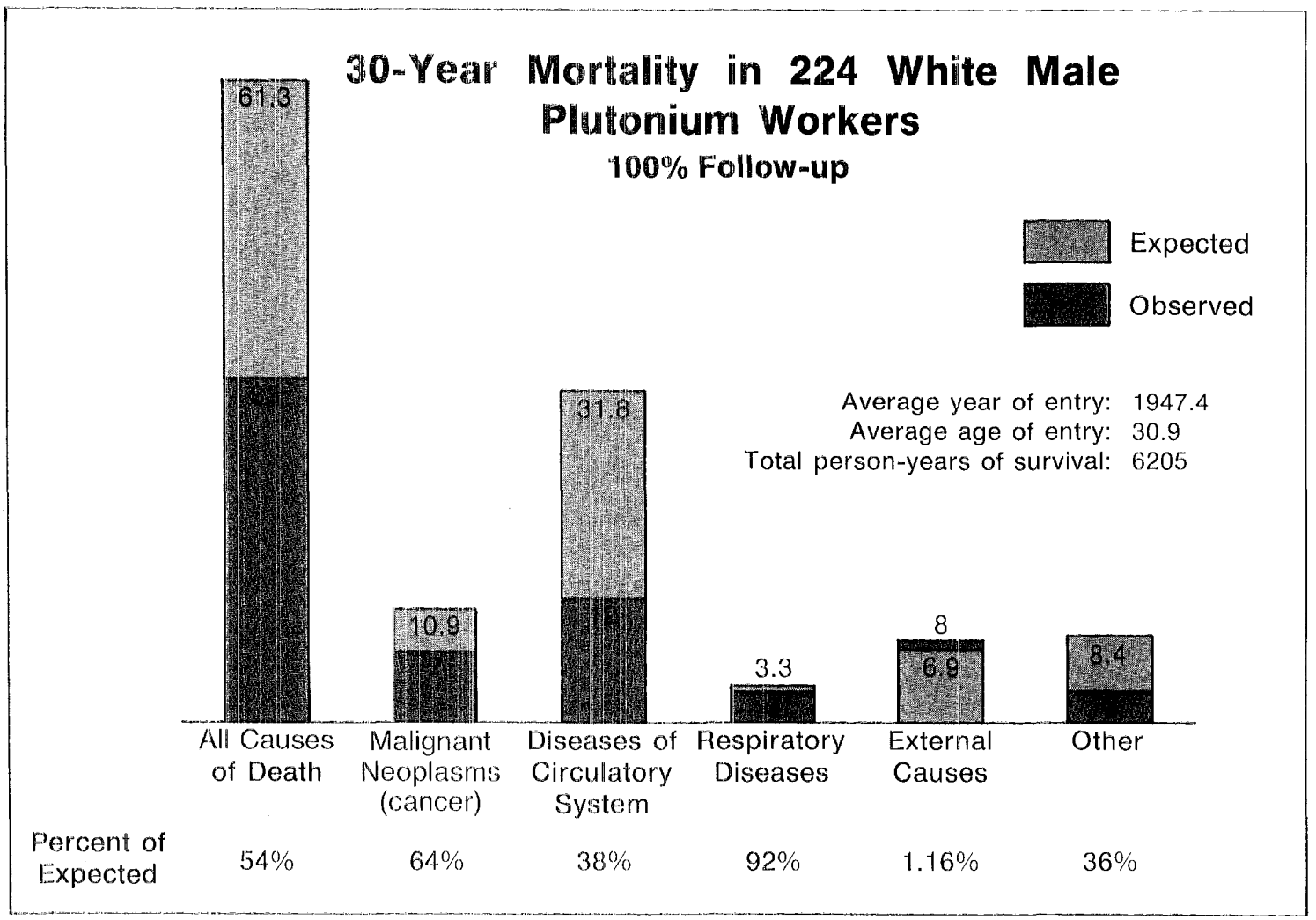
The 20,000-subject study will include workers both with and without measurable plutonium body burdens. It will also include some persons not exposed to radioactive elements. These persons will be used as a control group for comparison.

Compilation has begun

Compilation of records has already started for four sites: Los Alamos, Rocky Flats, the Mound Facility, and the Savannah River plant. H-14 is putting the finishing touches on the questionnaire that will be sent to the study subjects. Tracers have already started to match the subjects with current addresses in preparation for the mass mailings.

It's an ambitious project, one that will continue as personnel change through the years. But once completed, it will provide a lot of information to people who help protect workers involved in the nuclear industry.

The established findings will increase in importance, especially now as plutonium is not only the stuff of which bombs can be made, but can also fuel breeder reactors to keep homes warm and the refrigerators of the future running.



Wanted: Attributes of a detective, bill collector, and advice columnist.

LILIAN'S SEARCH

Lilian Anaya takes collect phone calls in the middle of the night from people she never met. It's part of the job.

She gathers old, dusty phonebooks to pore over at home, and gets excited when the new editions come in. It's part of the job.

Once she had an opportunity to tell a hospital it forgot to issue a death certificate 12 years earlier. It's part of the job.

The job? Tracing—a painstaking, slow, but vital tool used in epidemiological studies such as recently completed at LASL. These studies, directed by the Health Division, showed mortality rates and causes of death among selected plutonium workers here. (See a separate story.)

To compile the data epidemiologists needed, 224 workers selected for the study had to be tracked down. Some had been here during the 50s, and left. Some had remarried or changed their names. Some seemingly disappeared. Some had died.

It was Anaya's task to track down each of the 224. If they were alive, she needed an address. If not, she needed a death certificate to pinpoint the cause of death.

Persistence

Her main tools were a telephone, directories from cities all over the nation, and persistence. About half of the persons on the list were easy to find. They were still listed in local phone books, or had relatives with the same last names who were listed and could provide their current addresses.

Sometimes, there would be a lot of potential relatives with the same last name. Until she could find a lead, Anaya would call each one asking if they knew "John Smith." If they didn't, might they know someone who did?

If the person sought had an unusual name, or the phone books showed no potential relatives, Anaya tried to track him or her down via directory assistance. Local operators got first crack—if they could provide no leads, operators in cities where the persons had once lived were contacted.

Anaya eventually compiled a list of persons to seek via the operators. One hitch: telephone service rules stipulate only three questions can be asked of an operator at a time.

What this meant was if Anaya had a clue "Joe Brown" lived in the Los Angeles area, the operator there could look up his name in three suburbs he might reside in, before she told Anaya to hang up and try for another three guesses. Or, if the operator had 15 Joe Browns, she had to call the operator five times to get all their numbers. Anaya kept careful records of her phone calls. On one day, she made 120.

But the chase was on. Half of the 224 persons sought were relatively easy to find and match up with current addresses. The remaining half of the list was harder, and required the skills of a detective, the persistence of a bill collector, and the sympathetic ear of an advice columnist.

One person, the object of weeks of search, was finally pinned down. When Anaya reached his home number, the man was not at home. Elated that she had at least spoken to the son, she told him, "Please have your father call back tonight, no matter what time it is."

He took her at her word. That night, at 1 a.m., she got a collect call from the person. He provided his current address, and in return, Anaya gave him news about the Laboratory he had once worked for.

Clark Kent case

One of the longest searches she made was for a man who had contact with the health facility here in 1956. The man was a New Mexico newspaperman, and had been issued a clearance and Z-number to allow access to the then-closed Los Alamos site.

His case was difficult from the beginning. On the hospital registry he signed in 1956, he used a shorter version of the name issued with the Z-number. And he didn't write clearly, so there was initial confusion over his first name.

After some work, Anaya was able to match the registry name with the Z-number name. But she had no address for the man, either past or present. It was time to hit the phonebooks.

Mail and Records supplied old directories from years past. For story-telling purposes, let's say the man's name was Clark Kent. (All names in the study are kept confidential.)

Anaya would page the old directories year by year, looking for listings under Kent. Then she would trace the listings in progressively newer directories, until she found a lead, or the listing stopped.

If she hadn't found a recent lead, or the listing stopped several years ago, she would go to the reverse directory. This handy tool lists telephones by addresses, not names. Using this, she could find persons who might have been neighbors of the Kents, and could provide leads to where they moved.

But Kent and his family weren't listed in Los Alamos area directories, nor could Anaya find any local folks who knew of them. And the newspaper he worked for had long since destroyed his personnel records. It looked like a dead end.

Then, some old health records at LASL surfaced, and Kent was listed. The only information Anaya could glean was that Kent said in 1956 he had next-of-kin in Connecticut.

"That night, I took home all the phone books for Connecticut and went through each one," Anaya remembered. "I called every Kent I could find, asking them if they knew Clark or the person he listed as his next-of-kin, but I couldn't get another lead."

Then the new editions of the Connecticut phone books arrived. Anaya turned to the Kent listings, and there was the next-of-kin.

It was a red-letter day for Anaya, because by this time, months had elapsed since the search for Kent began. "I was so excited, I couldn't do my work. I started screaming and hollering, 'I found her, I found her!' My boss told me to pipe down."

The next-of-kin turned out to be the 97-year-old sister of the man. She told Anaya that Kent had died almost 10 years ago, that he had had three wives, that they had all died, and no, she didn't know where her brother was living when he died.

Anaya needed that last bit of information to get the death certificate. So what had looked like the end of her search turned out to be a blind alley.

"I was really depressed," Anaya said of this latest turn of events.

Still she persisted. Another call connected her to the elderly woman's daughter-in-law, who in turn talked to another relative. This last relative said she had an old post card from Kent when he was in Arkansas. She thought it was Pine Bluff.

This was a lead. Poring over the Pine Bluff directories published during the 60s, Anaya found a listing for Kent. Though he disappeared again in later directories, she could now use the reverse directories to locate persons who had lived near Clark when he was in Pine Bluff. She found someone who recalled he was an organist in a cafeteria which no longer existed.

She then called all the churches and found two persons who remembered him, but only that he had "white hair and was real nice." They couldn't provide any information on when he died or where.

Then she called the staff of the Pine Bluff Library. Did they have obituaries? Yes, was the answer, and they are filed by name and year of death. But the obits were on microfiche, and a search for one individual would cost more time than the on-duty librarian could spare.

But the staff there did locate a woman who would search, for a small fee. Anaya contacted the woman and told her what she was looking for. A week later, Anaya received a bill for $15 and the man's obituary which had all the information she needed.

The search took 8 months. "He (Kent) was the hardest" Anaya said, "but when you've got a lead, it's hard to let go."

100 per cent rate

It was this persistence that yielded a 100 per cent follow-up rate for the 224-man study. "That's rare," said James Stebbings, A LASL epidemiologist who helped coordinate the study. "The usual success rate for a study of this size is about 90 percent. It was Lilian's personal interest in the subjects' stories that kept things going when others might have been discouraged."

Straighter record

Anaya's efforts even helped a Santa Fe hospital set its records straight. She had information from a relative that a study subject had died a while ago. The man was a local resident, but neither his daughter nor the Bureau of Vital Statistics had a death certificate. Nor did the hospital where he had died have any record. Someone there just forgot, and the error might have gone unnoticed forever had not Anaya, in her pursuit of the 100 per cent success rate, been able to point out the goof-up. So in 1978, they issued a certificate for a man who had died in 1965.

The fact that Anaya was bilingual certainly didn't hurt when she had to follow leads in small villages with largely Spanish populations. Her enthusiastic manner came over the wires, and she found herself often listening to reminiscences about the old days.

Many of the persons were excited and pleased when she called, identified herself and her employer, and the purpose of her call. They'd share with her stories of projects they had worked on, asked for former co-workers, and requested copies of recent *Atoms* to catch up with happenings.

"I know they call this job 'tracing,' but I call it getting to know people, and it was fun," she said of her work.

It was a real private eye routine to track down many of these persons, and get their current addresses, or death certificates. But, said Anaya, it was "the best job I ever had."

Postscript: Anaya, along with other members of the Epidemiology Group (H-14) is preparing for the nationwide study of plutonium workers, described elsewhere in this issue.

—CAR

Persistence yielded a 100 per cent follow-up rate, thanks to personal interest. Many people shared stories and asked for current information.

THE SOBERING CHINESE ELEMENT

Photo by John Flower

John H. Morse recently took a series of long overland trips through China, across Mongolia, and through Moscow via the Trans-Siberian Railway. What he saw was a Chinese culture bent on modernization and genuine friendship toward the U.S. A second observation was a Soviet Union still prepared to inflict hardships on itself for goals related to its defensive strategy.

Just how the three superpowers interact over the next few years may determine whether the nuclear weapons designed at Los Alamos and Livermore are ever used, Morse concluded. "The Russians have got to think more even than they do now . . . The Chinese just might be the element that keeps the Soviets sober."

Morse is an advisor to many government and civilian agencies. He previously held posts with the National Security Council, as Undersecretary of Defense, and as a deputy to the Atomic Energy Commission, among others. He was in Los Alamos for three days to talk of his observations, which he had shared with fellow traveler Bill Scott, former Air Force attache in Moscow, and their two wives.

In China, the entourage was given permission for a quasi-official agenda not available to the stock tourist. They talked to officials, people in the streets, and toured the National Defense College and the 38th Air Division installation near Peking. Morse concluded that Chinese at all levels are genuine in their official change of feeling toward America, and equally sincere about their anti-Soviet emotions. They are also determined to modernize their country by the turn of the century.

Why the Chinese change? "We found that Big Brother is a bully," said one. "And we found out that if we want to work with the Russians, we have to do it their way."

Mao Tse Tung's ideology is used "as a front" by the Chinese, who retain his posters and quote his sayings. Many of his policies—such as moving intellectuals to communal farms, closing the universities, and withdrawing from the world—are being re-

Russia lost 20 million lives in WW II. They'll pay that kind of penalty.

versed. While Mao encouraged families, the Chinese today may not marry before the age of 23. A one-child family is given a subsidy; families with three or more children are penalized. A wide range of ills is blamed on the Gang of Four, but not on Mao.

Morse, who was assigned to Japan in 1945 a month after the Pacific surrender, wondered then how that country did so well with equipment that looked outdated. Today, the Soviets are most worried about any Japanese-Chinese alliance, and the Chinese just might duplicate Japanese progress.

China faces questions of government stability and will have to adopt some methods of capitalism and technology to achieve modernity. Extra money and energy may come from offshore drilling, if oil can be found and developed as an industry within five years. This is a top priority, along with nuclear weapons development. In education, the Chinese seek to re-establish some 400 universities and aim for 800,000 scientists and technicians by A.D. 2000.

Morse visited an air raid shelter, reached via a door hatch hidden as part of the floor in a crowded urban clothing store in Peking. His hosts said there were 3,000 meters of tunnel space on different levels below 270 meters of street, and that all cities in China were so honeycombed. He was also told that most urbanites could reach a shelter within five minutes (this one had 91 entrances) and could stay for two days. The shelters, equipped with ventilators, airtight steel doors, first aid stations, and cafeterias, are examples of the Chinese-perceived need for survival and their increased fear of the U.S.S.R. since about 1969.

The pragmatic Chinese have decided to emerge from 30 years of seclusion, but the Russians don't expect severe changes in outlook, said Morse. Most Americans, not attuned to history nor to the study of languages, have no idea how different the Russian experience—and world view—is.

In Moscow, Morse witnessed midnight practices for last year's May Day parade that was to be held in Red Square. It reminded him of many customs that have changed little since they were described by the French observer Marquis de Custine in the 1840s: The Russians still popularize fetes and parades of the rulers; the secret police is omnipresent; personal and public liberty is nearly nonexistent; the church is subjugated; populations are still transplanted to Siberia; noncomformists are represssed; and foreign lands are subject to conquest.

The Marquis' book was found in the original French in a Moscow bookstore by a surprised American embassy staffer, and was translated into English and reprinted. The Marquis, whose father and grandfather had been guillotined in the French Revolution, went to Russia convinced that representative government wouldn't work. "He came back terrified, and he came back absolutely convinced the other way," said Morse.

What other country, asked Morse, do you know that must resort to a Berlin wall to keep citizens in, instead of keeping foreigners out?

Russia has averaged a two to five per cent improvement for its people each year since its revolution and seems unlikely to change this pace, he said. They are proceeding with a massive conventional and nuclear force buildup because they remember a 2,000-year history of invasions and are more defense-conscious than we. They think of strategy in terms of unchallengeable defense; we operate as if strategy consisted of numbers, manipulated by mathematicians and economists.

Russia covers a sixth of the Earth's land surface, and the country grew by gradually absorbing areas thought of as buffer zones. Nuclear missiles have changed the strategies of the Hitler and Napoleonic eras. While the Soviets are still willing to use negotiations to protect their interests, they are also willing to use deceit or military methods where necessary. Either way, the rest of the world has to be rendered harmless. In Cuba, for instance, the presence of 3,000 Russian training troops means the "training of Cubans to be proxy troops in the Middle East" is under way, said Morse. That could create severe problems for regimes still in control there, he added.

The U.S. was colonized by tough, venturesome immigrants, people who found unlimited land and resources, along with a benign government and climate. "It was nirvana. Any man could make it." This made us pragmatic, but also made us unthinking and isolated, both physically and mentally, said Morse. In addition, our total losses in all our wars have been one million dead.

Russia, in contrast, has lost an estimated 45-50 million people in this century alone: two million in WW I; then 12 million people in purges and civil war in 1918-22; then 20-25 million under Stalin's purges and labor camps; and at least 20 million in WW II—including one million in the siege of Stalingrad alone.

"The Russians are tough, and they'll pay that kind of penalty," said Morse.

The U.S. should be firmer when dealing with either China or Russia, said Morse, because they fear war even more than we do and are disinclined to "chew up each other" while we remain a world power. And perhaps we should look at the Russian situation and ask ourselves about the consequences of trying to be a risk-free society, said Morse. "Imagine a Ralph Nader heading a Western wagon train."

Can we meet emerging problems, given our history and attitutdes? "I don't know," said Morse. But if the situation gets desperate between superpowers, inhibitions over human rights violations and the use of nuclear weapons "can change—like that!"

He said Los Alamos' and Livermore's work is important to the national defense, and hoped that nuclear weapons would never be used. But he also said, "It may well be that the things you fellows have worked on will be in demand."

Morse told of two men who were debating world wars. The first, they concluded, was a chemists' war. The second was a mechanical engineers' war.

The third? "It was psychological. And we've lost it."

—JLP

Reclaiming Silver at Los Alamos

With more than 30 darkrooms, small amounts of silver become significant.

By VIC HOGSETT

Once the richest darkrooms were uncovered, Riechman and Duran secured hardware. The local contractor came in the form of Omar Gallagher.

Shades of the 1950s gas wars. A Lexington, Kentucky, service station owner still sells a gallon of gasoline for less than two bits; he'll take a dime for a soft drink. He sells his products at higher rates, if the buyer is using current money. But if you have a pocketful of pre-1965, all-silver coins, you can fill your 20-gallon gas tank for less than $5 (face value).

With silver prices currently hovering around $15 an ounce (the price has been changing daily), the economic tactics of this station owner are pretty sound. According to figures furnished by a Los Alamos coin dealer, the owner is getting more than $2 per gallon for gasoline. The problem, of course, is that all-silver coins are indeed rare items in most purses and pockets. To most people, pure silver is probably rarer.

The price of silver bullion has increased more than 90 per cent in the last several months and more than 293 percent in the past year, according to John Quicksilver, publisher of a numismatic newsletter. At the same time, the industrial and artistic demands for silver have increased dramatically.

On track here

These factors and a desire to protect Los Alamos' environment put Norman Riechman and Bennie Duran, both from SP-2 (Supply and Property Department), and Wally McCorkle, H-7 (Health Research Division) on the track of setting up a silver reclamation program at the Laboratory. They initiated the program in 1966 and got the jump on a General Services Administration mandate that said federal installations should reclaim silver when feasible.

"It seemed to us we shouldn't be throwing good silver onto the ground when it is very easy to collect—we started collecting it," Riechman said. "We've been doing that reclamation since before it was a rule."

The silver is most commonly claimed from used photographic solutions, film, and unneeded photographs. Modern black and white photography is based on the principle that some silver halide compounds are light-sensitive. The image on a photograph, transparency, or negative is formed by silver particles reacting to light. When a photograph or film is permanently fixed, the unreacted silver particles are washed into photographic fixing solution. What is left on the film or paper forms the image.

Over a period of use, the fixing agents become rich with reclaimable silver, and useless for photographic purposes. Black and white film, photographic paper, and x-ray film contain small amounts of silver that also can be reclaimed. With more than 30 darkrooms set up around the Laboratory, it doesn't take long before those small amounts of silver combine to achieve economic significance.

Search for the lodes

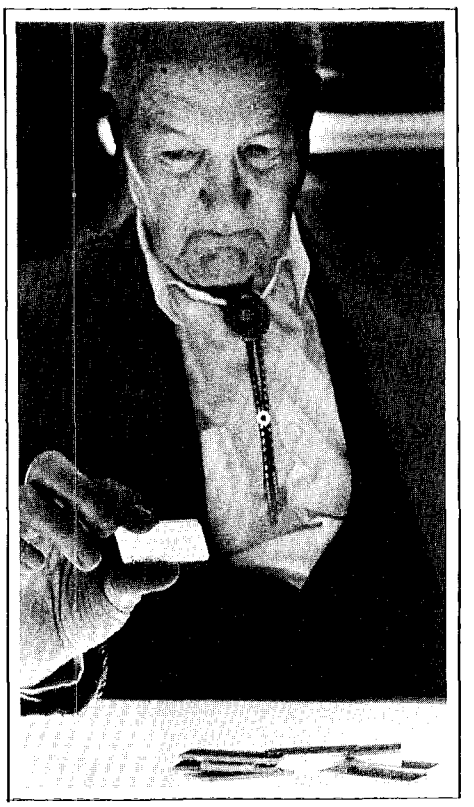
The trio began its trip toward conservation by assessing the extent of silver lost at the Laboratory, which darkrooms were likely to contribute the most silver, and the impact of releasing photographic wastes into the environment. Help came from several sources throughout LASL, including Charlie Metz (then CMB-1 group leader, now deceased); Jack Fullbright; and Roger Morris (then both GMX-1, now in M-1).

"The darkrooms at ISD-7 were found to give the best and most silver," Riechman said, "but we began collecting from several darkrooms, including x-ray processing labs."

Once the richest darkrooms were uncovered, Riechman and Duran secured the necessary hardware from Eastman Kodak. For liquid reclamation, that included hypo collectors and filter cartridges that were placed on automatic photographic processing machines. Periodically, the filters were collected and sent back to Eastman Kodak where the silver was reclaimed and either reused or sold.

Riechman said this process became cumbersome and they began looking at the possibility of obtaining an independent contractor nearer to LASL, particularly a person or firm that could carry out most of the duties.

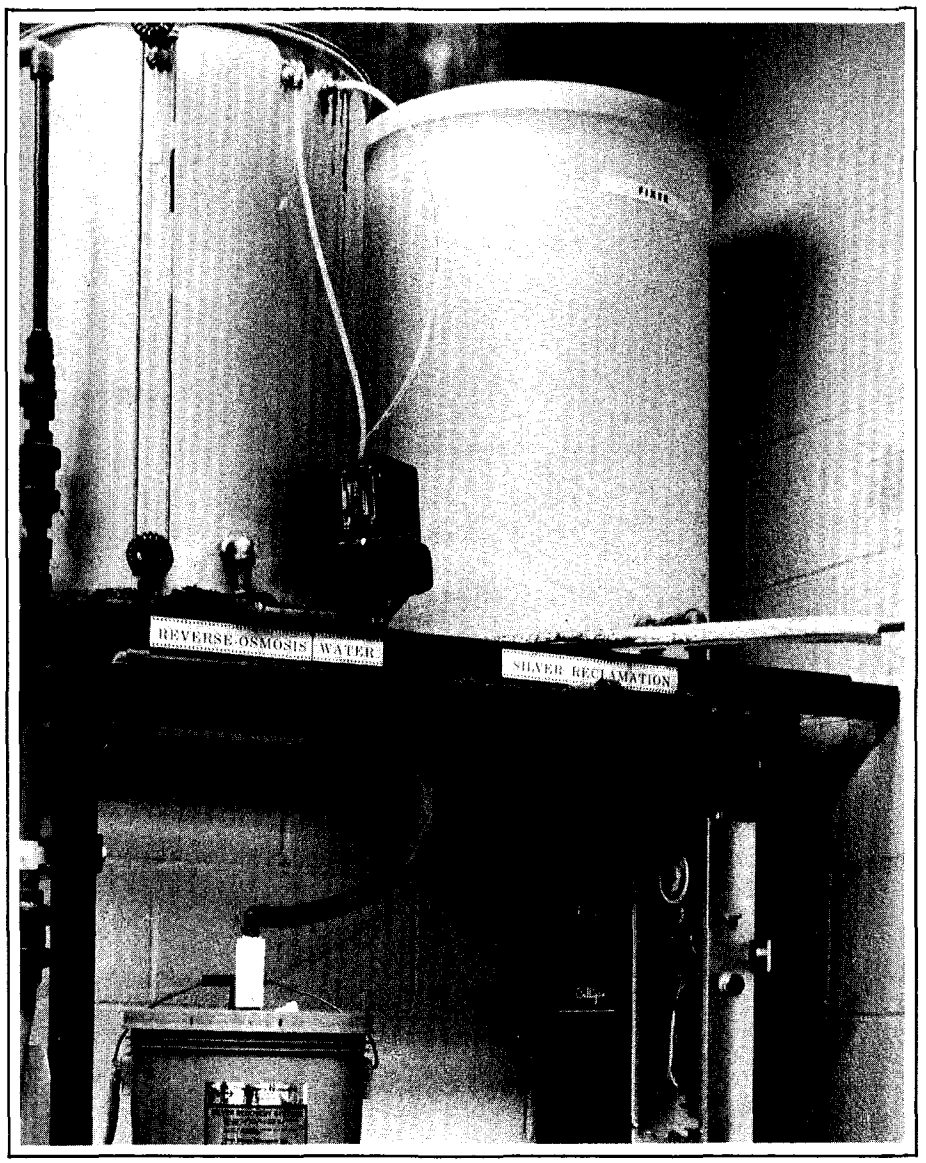
Solid black and white photographic scraps, both classified and unclassified,



Periodically, Omar Gallagher can be seen looking for rich hypo solutions and heavy filter cartridges. Gallagher evenly splits the profits with LASL.

Photo by Bill Jack Rodgers

Photo by Bill Jack Rodgers



"If the penny takes on a silver color in a short time, the hypo is ready for processing. When the filters weigh about 80 pounds, they're ready." *Photo by John Flower*

were boxed and shipped to Sandia Laboratories in Albuquerque where they were incinerated "behind the fence." The remaining silver-laden ash was reboxed and sold to the highest bidder. Sandia continues to handle LASL's solid photographic wastes in the same manner.

The local contractor

The local contractor for liquid reclamation came in the form of Omar Gallagher.

"He's an old hand up here," Riechman said. "He used to work in ENG-4 and retired in 1968."

Under the terms of Gallagher's contract, renewed yearly, he furnishes the filter cartridges, labor, and five-gallon pails used to collect the hypo sludge from developing trays. Periodically, Gallagher can be seen around the Laboratory looking for rich hypo solutions and heavy filter cartridges.

"You can tell how rich a hypo solution is by dipping a copper penny into it," Gallagher said. "If the penny takes on a silver color in a short time, the hypo is ready for processing. I also have test strips that tell the same thing. When the filters weigh about 80 pounds, we know they're ready."

Gallagher takes the hypo solutions collected in five-gallon Cubitaners from developing trays to SM-142, where they are placed in a 55-gallon barrel and—through electrolysis—stripped of their silver.

"When it goes through the electrolysis unit, the silver is plated on a stainless steel cylinder," Gallagher said. "At that point, it is almost pure silver."

He collects filter cartridges from automatic photographic processors throughout the Laboratory. The cartridges are sent to a Garland, Texas, firm for processing. The silver thus collected is sold for jewelry, industrial needs, or for other purposes. Gallagher evenly splits the profits with LASL.

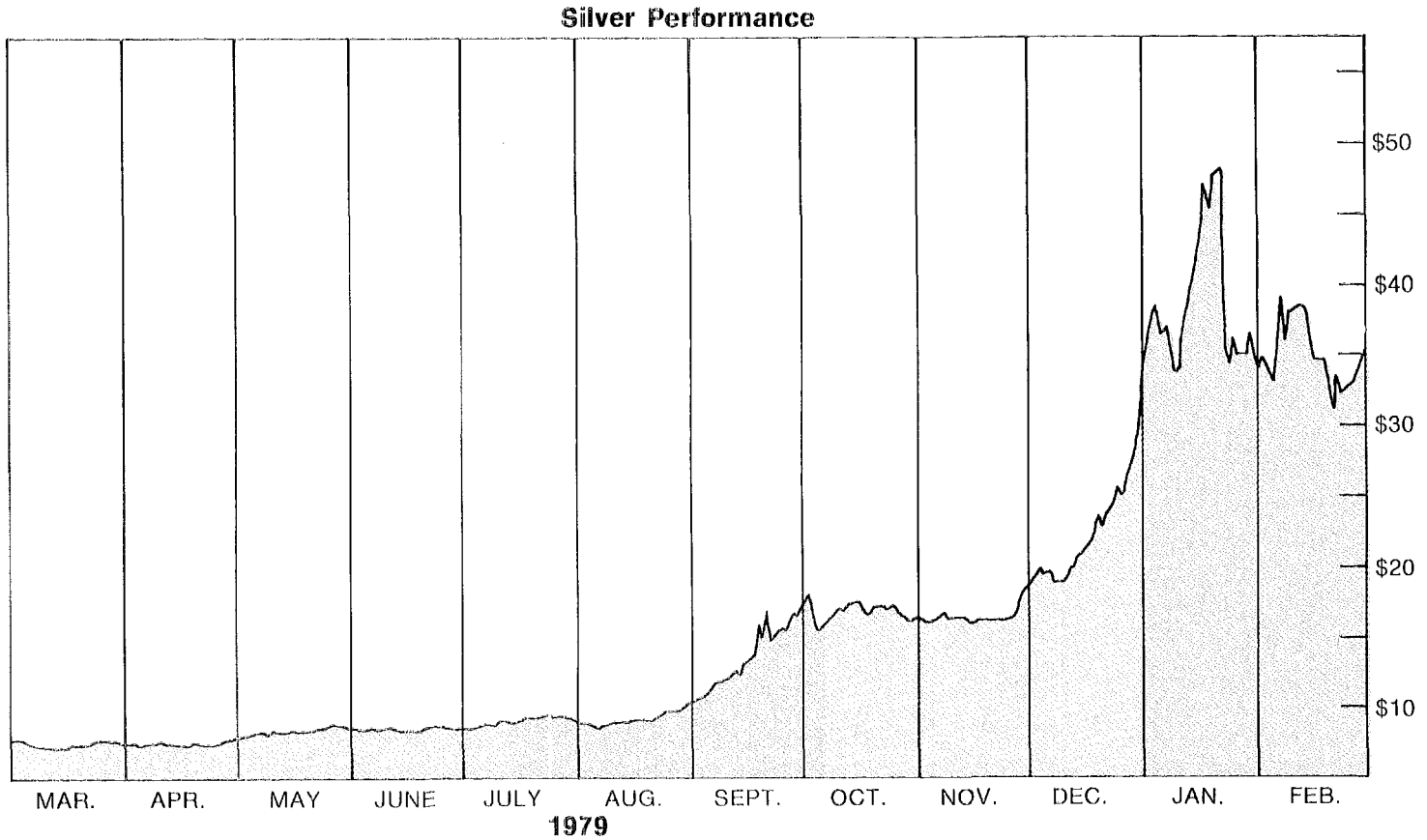
"For this, we don't have to do anything, just collect the checks," Riechman pointed out. The checks have amounted to about $30,000 so far—about $3,000 in 1979 alone. Riechman added, however, that LASL receives no money for its solid scrap.

"But there aren't any real direct costs to LASL. We send it down to Albuquerque on regular shuttle runs. Whether our film is on the truck doesn't matter; it goes anyway," said Riechman. He reminded employees that the LASL *Bulletin* routinely advises proper packaging of solid photographic scrap, particularly for classified photographs.

Environmental protection

Riechman admits that the economic benefits of the silver business were secondary to a need to protect the environment. That is where Wally McCorkle came in. He once worked for the Environmental Protection Agency (EPA) and is now involved in environmental surveillance work at the Laboratory. It is his job to monitor

The checks for LASL so far have amounted to $30,000—close to $3,000 in 1979 alone.



effluents for point source discharges, which he said are broadly defined in legal terms as almost any discharge that could be a hazard to plants and animals, from almost any source.

"We are concerned with keeping all compounds out of the environment that can be easily removed through waste management," McCorkle added.

Pure silver is relatively nontoxic, he said, but it often coexists in waste discharges with other compounds that may be toxic, including cyanide. The discharge of these and other chemicals is tightly controlled by the General Accounting Office, the EPA, and the Environmental Improvement Division (EID) of the New Mexico state government.

McCorkle said he was happy to report that LASL has been certified as complying with the three agencies' standards, with respect to photographic waste discharges. To ensure compliance, he monitors 14 discharge points weekly on a non-set, rotating basis.

"We don't tell the person responsible when we are monitoring a certain point," he said. "We compile a monthly summary that is submitted quarterly to the EPA and the state EID."

Riechman and Duran seemed pleased that they are able to turn an otherwise waste product into cash for the Laboratory. But what about that Lexington gas station owner? His position is somewhat different; he says he has never sold or used any of the silver coins taken in trade. He added that he likes the lustrous tender and would never consider parting with it.

An un-mercenary look at silver? His may be, but as we said, silver is not getting any cheaper.

Years Ago

30

Indians and water

The Los Alamos water supply problem has reached serious proportions, and a decision as to the use of Valle Grande sources must be reached by April, according to AEC manager Carroll Tyler. Indian leaders have raised objections to tapping the water, since it might reduce the amount available for irrigation at the pueblos. The AEC has guaranteed funds for a permanent storage system, so pueblos could use water when seasonal runoff doesn't meet their needs.

Hatch Act still holds

Residents who harbor political aspirations received a setback in the form of a letter from the U.S. Civil Service Commission stating it "has no authority under the Hatch Act to sanction participation by Federal employees in partisan political elections." The letter was a reply to a query by F.C. DiLuzio, chairman of the board of county commissioners. The question was primarily raised to clarify the position of federal workers who were considering entering the race for county offices. The Hatch Act forbids federal employees from engaging in politics. According to the latest word, no exceptional situation exists in Los Alamos.

20

No FHA insurance in White Rock

There will be no FHA insurance for mortgages on homes in the proposed White Rock development, confirmed George M. Case, who directs the Federal Housing Authority in Albuquerque. After re-examining the location, Case said there was no reason to change the 1957 conclusion under existing rules. Reasons for refusal are: (1) the remoteness of the area from adequate community facilities such as stores and churches, and the belief that expected growth would not bring these to White Rock in the foreseeable future; (2) the area would depend almost entirely upon Los Alamos for its existence, and dividing the market for housing between the two locations would reduce the development rate for each. More suitable sites, said Case, may include Barranca Mesa, the Old Tech Area, and the Sundt apartment land.

Temporary dormitory days over

The old dorms are dormant for the first time since the first of the "temporary" buildings was hammered together in late 1943. Back in the dorm heyday of 1947, nearly 1,800 rooms were in use. Most of the 8-by-10-foot cubicles were occupied by two persons. At the end, 18 men were living in Iris Street dorm 264. The Zia Company, which until this month operated the dorms, had been doing so at a loss. Only six of the many dorms around town remain on Iris Street. They will be used to house summer students.

10

Environmental trapline

Environmental studies, conducted here for more than 20 years, monitor the atmosphere, soil, and water to determine whether radioactive materials are present. In general, the studies are conducted to make sure nearby areas are not affected by any contamination coming from the Laboratory. Air samples are collected from 24 stations; soil samples come from canyons; and water samples come from 178 sites. Members of the Radiation and Meteorology sections are also involved in test operations in Nevada, the Pacific, and the Aleutians.

Night before noon

The so-called "eclipse of the century" blacked out the sun for 17 hours and 38 minutes March 7 over the Gulf of Mexico. Aboard an Air Force plane, LASL men ran data-gathering programs. Art Cox, J-15, estimated that interception of the speeding spot in time and space occurred with an error of one second; the plane was flying at 585 mph, seven miles up from Earth. Wrote Bill Regan: "The last rays of the eclipsed sun flashed through the jagged topography of the moon's edge and the beautiful light-show called Bailey's Beads appeared as a string of shining jewels."

Taken from files of Los Alamos News, LASL Community News, and The Atom.

Among Our Visitors

Carol Sapin Gold, a consultant, author, and faculty member in the field of management development, drew an inquisitive crowd after a colloquium talk. Gold, who has formed her own company, spoke on women in the business world.

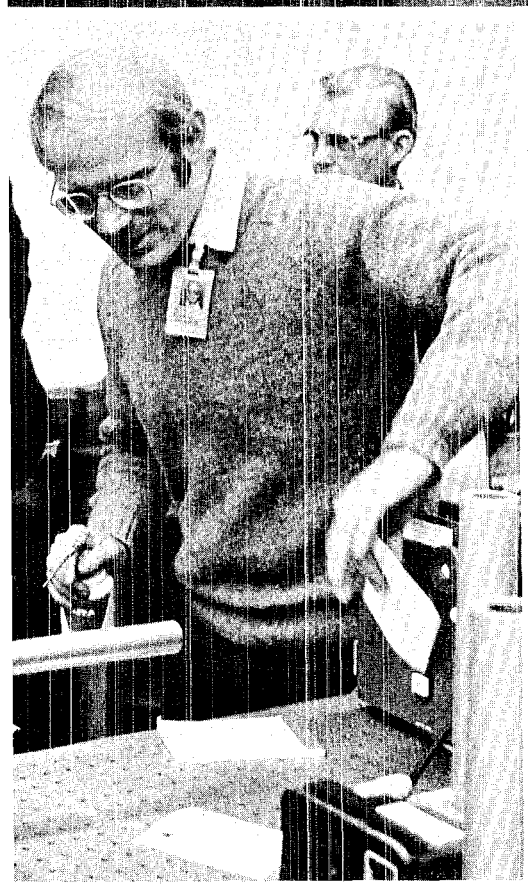
A laser demonstration by Mel Buchwald of the Applied Photochemistry (AP) Division was part of the itinerary for the University of California Special Research Projects Committee. Chaired by Regent William A. Wilson, the committee is responsible for overseeing research in the laboratories which are managed under contract to the DOE.

Photo by Bill Jack Rodgers

Photo by John Flower

☆U.S. Government Printing Office: 1980 — 677–154/2

short takes



etc...

A 35th anniversary reunion will be held June 13-15. The Los Alamos Reunion Committee has mailed information to 2,500 "veterans and pioneers" who were involved in the Manhattan Engineer District, Project Y, from 1943 to 1945. Address updates are needed; send a note to P.O. Box 78, Los Alamos NM 87544. Reunion activities will include informal socials, tours, and a ceremonial program. Past Directors Norris Bradbury and Harold Agnew, and present Director Donald Kerr, have been invited.

Thomas A. Sandford, an employee since 1960, is now the Associate Director for Engineering Sciences. He is responsible for assisting in technical issues, financial management, capital equipment, personnel, and organizational review. Sandford was recently group leader of WX-1.

The Geosciences (G) Division has been reorganized, with a majority of scientists assigned to groups that represent disciplines, as opposed to specific projects. The division now consists of nine groups and three offices. Among the duties of G-Division are: aspects of containment of underground nuclear weapons testing; the federal hot dry rock program; fossil fuel research; and atmospheric studies.

The final environmental impact statement on LASL has been issued by the Department of Energy. The 600-page document addresses environmental implications of activities, and assesses actual and possible effects on surroundings. Copies may be obtained by writing to Washington and are locally available for review. The statement also evaluates the effects of all types of waste disposal, and the effects of postulated accidents at LASL.

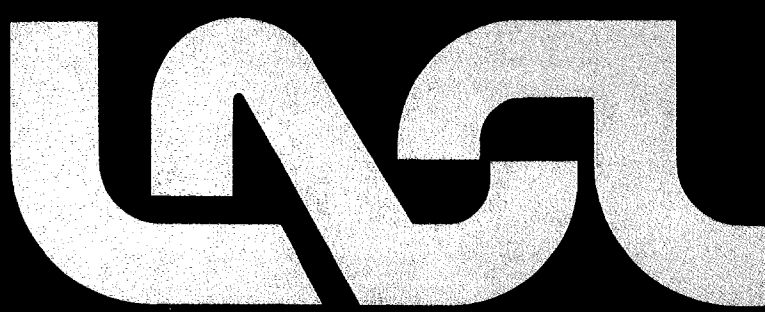
The Laboratory has announced a reduction in force that has affected 23 people in the Physics (P), Energy (Q), and Systems, Analysis and Assessment (S) Divisions. Reasons included program shifts, end-of-project dates, and some funding cuts. Many of the 23 either found jobs elsewhere in LASL or took early retirement; some left. Major programs affected were the Superconducting Power Transmission Line Project, Tritium Systems Test Assembly, and Inertial Fusion Systems Studies.

David Freiwald next year will take over duties as president of the New Mexico Academy of Science. He has worked here since 1972 and currently is Assistant to the Associate Director for Energy Programs. The academy is an affiliate of the American Association for the Advancement of Science.

errata/addenda

A typographical error resulted in the misspelling of James D. Doss's name in the last issue. With three other LASL staff members, Doss was granted a patent on an electrosurgical knife.

Inadvertently omitted in the composition phase of the last issue were arrows in thermochemical equations for making hydrogen on page 17. We regret any confusion this may have caused to readers.



LOS ALAMOS SCIENTIFIC LABORATORY